Chapter 5

PROJECT EVALUATION AND COST ANALYSIS

INTRODUCTION

Project evaluation is a micro planning technique which is used to assess the social desirability of a project in valuing public expenditure. It is the evaluation of the cost and benefits of each investment proposal meant for inclusion in a plan. It implies an appraisal or assessment of a project as to its operational efficiency technically, economically, financially and managerially. It also gives the effect of new project on the people of the area in which it is located, particularly on their ;economic and social conditions. Indian Planning Commission observes that Evaluation is an essential aid to policy. It may be considered as a branch of action programme. It is an integral part of development programme. According to Hyman, "Project evaluation refers to the procedures of fact finding about the results of planned social action, which, in turn, move the spiral of planning ever upward. It is tne proper methodological accompaniment of rational action." It is the most specialised planning process which involves systematic, objective and comprehensive appraisal of development programmes for individual commodities and projects. It is a process to evaluate the rate of return on a project, its social profitability and its side effects on growth rate of population, on employment and on rate of investment. Project Evaluation utilises principles similar to those.... for the evaluation of industrial sectors but it requires more extensive study of individual elements." The technique of project evaluation is useful both for developed and under-developed countries but it is more beneficial for underdeveloped countries. Prof. Little and Mirrless in their Manual of Industrial Project and Analysis commissioned by organization for Economic Cooperation and Development gives following reasons :

1. In underdeveloped countries, the actual market prices are worse reflectors of the true social costs and benefits than is the case in advanced countries. Price distortions are common feature in underdeveloped countries due to :
   - i) inflation in underdeveloped countries;
   - ii) currency over valuation in underdeveloped countries;
   - iii) imperfect capital markets in underdeveloped countries;
   - iv) Wages being not equal to marginal productivity in underdeveloped countries;
   - v) Inelasticity of demand for exports of underdeveloped countries;
   - vi) Protectionary policies of underdeveloped countries;
   - vii) Lack of market economy in underdeveloped countries.

2. All underdeveloped countries face the problem of scarcity of resources-human and material. For rapid economic development, it is necessary that these scarce resources are used optimally and rationally.
3. Social cost benefit analysis of a project is more necessary in these countries.

STAGES OF PROJECT EVALUATION

Project Evaluation is a multi stage process and usually involves four stages :

1. Description of the technical and economic characteistics of each project.
2. Estimation of the impact of the project on the economy both during the construction phase and operational phase.
3. Evaluation of the consequences of project which may be direct or indirect.
4. Formulation of criterion for the projects.

WHY PROJECT EVALUATION

Project evaluation is the axle on which the economic development revolves. A sound development plan requires a great deal of knowledge about existing and potential projects. The connection between investment and the rate of growth cannot be properly estimated without proper knowledge about actual and potential investment projects. To quote Harberger, "The essence of investment planning in underdeveloped countries consists of ranking projects in accordance with their benefit cost ratio and undertaking those in descending order until the savings available for investment are exhausted." After the allocation of the investment between different sectors, the planner will have to select projects within sectors to which investment is directed. If the division of investment between different sectors of economy is to be rational, it is essential that the costs and benefits of different projects in each sector should be assessed on a comparable basis. There are always a large number of projects computing for development while the resources for investment are limited. So, the planning authority has to choose between these projects and this choice is based on project evaluation. The selection and exclusion of projects cannot be made arbitrarily. The investment allocation must be made in such a way that net benefits are maximised. Thus, investment planning must be done with a view to allocate resources most efficiently. In a free market economy, the choice of project is made on the basis of net profitability of the projects. But in a planned economy, social gains and costs are considered while selecting and rejecting a project for a plan. In order to get maximum social benefit, investment has to be directed to those sectors and to those projects where it will be most beneficial for the economy. Realistic plans cannot be formulated in the absence of a great deal of project planning and without proper economic appraisal of projects.

COST BENEFIT ANALYSIS

The most popular method of project evaluation is to consider the cost benefit analysis of different projects and then to select involving lesser cost and yielding greater benefit. The role of cost benefit is explained by Prof. Marglin as, "The perspective and five year plans determine the broad strategy of growth by allocating resources among sectors. But the strategy of growth embodied in the plans leaves many tactical questions unsolved, and it is these tactical decisions that are the province of benefit cost analysis." It provides superior criteria for project evaluation in planned economy. It helps the planning authority in making correct investment decisions to achieve optimum resource allocation by maximising the difference between present value of benefits and costs of a project. Thus, cost benefit analysis "purports to describe and quantify the social advantages and disadvantages of a policy in terms of a common monetary unit." The objective function can be expressed as Net Social Benefit NSB = Benefits - Costs, where benefits and costs are measured in terms of shadow or accounting prices of inputs and outputs instead of in actual market prices.

GENERAL CONDITIONS FOR COST BENEFIT ANALYSIS

The project selection must be made on cost benefit analysis to formulate optimal development plans. The main considerations which may arise in the context of Cost Benefit analysis are as under :

1. Enumeration of Costs and Benefits

The first step of project evaluation is to consider a list of cost and benefits of a project. It depends upon the nature of the project. The social benefits of a project include the contribution that the project would make to the attainment of national goals.

CRITERIA FOR COST BENEFIT ANALYSIS

There are four benefit cost criteria discussed by the US Sub Committee on benefits and costs. They are :

i) B - C

ii) B - C/I

iii) $\frac{\Delta B}{\Delta C}$

ELEMENTS OF BENEFIT-COST ANALYSIS

Government acts to provide public goods or adjust formalities to divert resources from one use to another, thereby affecting peoples' present and future welfare. Such *welfare effects* may be positive (benefits) or negative (costs). Benefit-Cost analysis attempts to determine the net amount of the welfare effects *i.e.*, whether the diverted resources have greater value in their new use than in their former use.

More formally, Benefit-Cost analysis determines the present value, V, of the benefit and cost streams resulting from a particular government action, which we will hereafter refer to as a project. V is defined as

$$V = \sum_{t=0}^{T} \frac{B(t) - C(t)}{(1+r)^t}$$

The project's effects extend from the current period, $t = 0$, through future period T. For period t, the project's benefits and costs are $B(t)$ and $C(t)$, respectively. Projects that generate costs in the current period and benefits in the periods are called *investment* projects, in contrast with *consumption* projects, which generate benefits in only the current period. Traditionally, benefit-cost analysis has been used primarily for investment projects.

The benefits and cost of each period are discounted by the factor $1/(1+r)^t$. where r is the "discount rate". To obtain V, the discounted benefits and costs are totalled for all periods $t = 0$ through $t = T$. Benefits and costs that accrue in future periods are discounted to reflect the fact that future benefits are less valuable and future costs are less burdensome. In a subsequent section, we will discuss more fully the rationale for discounting and the problems met in defining and measuring the discount rate.

BENEFITS AND COSTS DEFINED

spent on education, for instance, must be the same as those from the last rupee spent on defence.

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CRITERIA FOR COST BENEFIT ANALYSIS

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(i) $B - C$ (ii) $\frac{B-C}{I}$ (iii) $\frac{\Delta B}{\Delta C}$ (iv) $\frac{B}{C}$

where, $B \longrightarrow$ benefits, $C \longrightarrow$ Costs,
$I \longrightarrow$ Direct Investment, $\Delta \longrightarrow$ Increment

The formula $\frac{B-C}{I}$ *is "for determining the total annual returns on a particular investment to the economy as a whole irrespective of to whom these accrue. If the private investment happens to be very large. then even high value of may be less beneficial to the economy. Thus, this criteria is not much useful to achieve satisfactory results. The another criteria of* $\frac{\Delta B}{\Delta C} = 1$ *is meant to determine the size of project. The adoption of the B—C* criterion favours a large project and makes small and medium size projects less beneficial. Thus, this criterion helps in determining the scale of project on the

basis of the maximisation of the difference between B and C. The best and most effective criterion for project evaluation is $\frac{B}{C}$. In this criterion, the evaluation projects B is done on the basis of benefit-cost ratio. If $\frac{B}{C}$, then the project is marginal because the benefits occuring from the project just cover the cost. If $\frac{B}{C}$, then benefits are less than costs so the project is rejected. If $\frac{B}{C} = 1$ the benefits are more than costs and the project is profitable and hence, it is selected. The higher the benefit cost ratio, more profitable will be the project.

The criterion discussed above does not account for the time factor. In fact, the cause society prefers present to the future. For this purpose, the economists have derived a number of decision rules or criteria. They are discussed below :

(1) The Net Present Value Criterion (NPV)

This is an important criterion for project evaluation. NPV = Present value of benefit — present value of operating and maintaining costs — initial outlay. It is also expressed as the net present value of benefits criterion so that,

NPV of benefit = Gross present value of benefits — Gross present value of costs.

If NPV> O then the project is socially profitable. If there are number of mutually exclusive projects, then the project will be highest net present value of benefits will be chosen.

The NPV criterion is not accurate method for project evaluation as it neglects the time horizon. Capital investments give benefits after a lapse of sometime. Therefore, future benefits and costs cannot be equated with present benefits and costs. So it becomes essential to discount future benefits and costs because society prefers present to future. The discount factor is expressed as :

$$D = \frac{1}{(1+i)^t}$$

where, i = social discount rate, t = time period

Thus, $$NPV = \left[\frac{B_1}{(1+i)^1} + \frac{B_2}{(1+i)^2} + \ldots + \frac{B_n}{(1+i)^n}\right] - \left[\frac{C_1}{(1+i)^1} + \frac{C_2}{(1+i)^2} + \ldots + \frac{C_n}{(1+i)^n}\right]$$

$B_1, B_2 \to B_n$ series of gross present benefits in years, 1, 2, ... – – n

$C_1, C_2 \to C_n$ series of gross present cost in years, 1, 2, ... n

$i \to$ social rate of discount

Only those projects should be selected in which present value of benefits exceeds the present value of costs i.e.,

$$\frac{B_1}{(1+i)^1} + \frac{B_2}{(1+i)^2} + \ldots + \frac{B_n}{(1+i)^n} > \frac{C_1}{(1+i)^1} + \frac{C_1}{(1+i)^2} + \ldots + \frac{C_n}{(1+i)^n}$$

The ratio of present value of benefit to the present value of cost should be greater than 1 for the selection of a project i.e.,

$$\frac{\frac{B_1}{(1+i)^1} + \frac{B_2}{(1+i)^2} + \ldots + \frac{B_n}{(1+i)^n}}{\frac{C_1}{(1+i)^1} + \frac{C_2}{(1+i)^2} + \ldots + \frac{C_n}{(1+i)^n}} > 1$$

(2) The Internal Rate of Return Criterion

The discount rate at which present value of return minus cost is zero. The mathematical formula for the computation IRR is (IRR)

$$B_1 - \frac{C_1}{(1+r)^1} + B_2 \frac{C_2}{(1+r)^2} + \ldots + B_n - \frac{C_n}{(1+r)^n} = 0$$

$r \rightarrow$ internal rate of return

In case of mutually exclusive projects, the project to be selected must have highest rate of return. **But this criterion has certain limitations which are given as below :**

1. It is not possible to change the rate of return assumed for the calculation of profitability of project.
2. It is difficult to calculate rate of return on long gestation project which does not yield benefit for many years.
3. This criterion is not applicable to highly capital intensive projects.
4. It is difficult to make choice between two alternative investments on the basis of their alternative internal rate of return.
5. It is difficult to calculate IRR in which the entire investment outlay can not be made in the first period.
6. The use of IRR for public investment does not lead to correct decision because it is not possible to discount intermediate benefits and costs of public investment at internal rate of return.
7. Layard points out the problem of capital retaining where projects can not be selected on the basis of their net present value.

3. Social Rate of Discount (SRD)

Since society prefers present to future, so future generations are likely to have higher levels of income. If the principle of diminishing marginal utility operates, then the utility gains to future generations from a given amount of benefits will be less than the utility gains to the present generations so the future gains must be discounted. *The rate at which future benefits must be discounted to make them comparable with present benefit is called 'social Rate of Discount'. In other words, it is the rate of premium which the society puts for preferring the present consumption to future consumption. This is illustrated with the help of adjoining* ***Figure 34.3.***

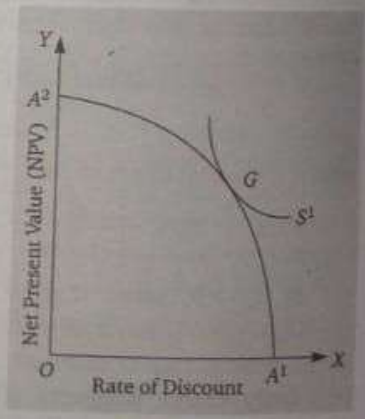

Fig. 34.3

The present consumption A_1 is taken along horizontal axis and future consumptions A_2 taken along vertical axis. A_1A_2 is the transformation frontier or investment possibility curve. It consists of a series of projects arranged from right to left in order of their rate of return the cost of sacrifice of present consumption ad the return is the gain of consumption in future. The society will choose from the various investment possibilities as as to reach its highest social indifference curve SI. The society reaches an optimal position when transformation curve A^1A^2 equal its social indifference curve S^1 at point G. The slope of the transformation curves represents the rate of return on investment and the social indifference curve represent.

The social discount rate is constant over time. "A discount rate of S per cent might well lead to twice as much investment as one of the 10 per cent together with equivalent reduction in consumption." If the discount rate is high, short period projects with higher net benefits are

preferred. On the contrary, when the discount rate is low long period projects with lower net benefits are selected.

Since the benefits and costs are to occur in future, they are discounted in order to find their present net worth so there is a problem of choosing suitable rate at which future benefits are discounted. Generally, the market rate is used for this purpose but it fails to solve the purpose where there is multiplicity of rate of interest in market or the private and social rate of discount may not conclude so there Is no scientific way of choosing a suitable rate.

Pigou and Dobb regard the use of **social time preference rate as '*pure myopia*'.** They allege that people are victims of "defective telescopic facility" that is why they prefer present consumption to future consumption. But they reject this view on the ground that society is a continuous entity and it has collective responsibility for future generations. So they favour zero social time preference rate because the present and future should have equal weights in the estimation of the society. According to **Marglin**, this view is an *"authoritarian rejection of individual preferences"*. **Sen and Eckstein** pointed out that the rational fear of death is sufficient for people to have positive social time preference rate.

Hirschleifer and other use the concept of social opportunity cost to measure the social discount rate. *"The social opportunity cost is a measure of the value of society of the next best alternative use to which funds employed is public project might otherwise have been put."* The next best alternative use of funds is investment in private sector. If they earn a rate of6 per cent, the public investment must also earn a rate of 6 per cent or more. Thus, social rate of discount is 6 per cent. If the public project earns 6 per cent, it should not be undertaken. Thus, the social opportunity cost method of calculating the social discount rate is not free from certain shortcomings. **Hence, it is difficult to find a rate of return which may measure the social opportunity cost of funds. According to Feldstein, the social opportunity cost depends on the sources of particular funds, it must reflect social time preference function.** He, therefore, suggests a method of combining the two. The procedure is to allow for the social opportunity cost of funds directly by placing a shadow price on the funds used in the project and to make all intertemporal comparison with social time performance rate. On the other hand, **Mishan** suggested that if the government has the power to invest in private sector, then the social opportunity will be under investment in the economy which requires a synthetic discount rate for public investment. The synthetic discount rate is some weighted average of the social time preference rate and the social opportunity cost rate.

Baumol does not agree with **Marglin** that there should be synthesis of the two rates. He regards the choice of rates as indeterminate because of the existence of risk and institutional barriers which will prevent the two rates to be in equilibrium. **Pearce** suggested that the correct answer to the choice of social discount rate does not lie in the selection of single rate, but in the use of both the social time preference and the social opportunity cost rates according to the type of benefits yielded and the type of forgone expenditure. He concluded that it would not matter which rate is chosen. If equilibrium conditions prevail, the necessity for the estimation of a synthetic discount rate disappears.

EVALUATION OF BENEFIT-COST ANALYSIS

The evaluation of Benefit-Cost analysis can be made on the following ground :

(a) **Evaluation on the basis of Benefit**—Benefits refer to the additional to the flow of national output resulting from investment in particular project. Those projects are said to be profitable whose contribution to national output is greater than those with a smaller contribution. Benefits may be real or nominal and direct or indirect.

I. **Real Benefits**—In benefit-cost analysis, we are concerned with real benefits rather than nominal benefits flowing from a project. A river valley project may increase irrigational facilities to the cultivators but if at the same time, the state levies heavy betterment levy on them, the benefit is nominal. But if the same project besides increasing irrigational facilities raises productivity of land per acre and leads to a number of other external economies whereby real income of the farmer rises, then, it is said to lead to real benefits.

II. **Direct and Indirect Benefits**—Direct benefits are those which can be obtained inhmediately and directly from the project and indirect benefits are those which are more or less identical to direct benefits. The direct benefits flowing from multipurpose project are flood control, irrigation, navigation, development of fisheries etc. But there may be also certain side effects of the project which may be categonsed as indirect benefits. For example, the construction of the Bhakra Nangal Project has provided employment opportunities to thousands of people. It led to the construction of new railway line connecting Nagal Township and the Bhakra Nangal Dam with the rest of the country. New roads have been laid. The Bhakra Nangal Dam has been developed into a tourist resort thereby augmenting income. The direct and indirect benefits must be taken into consideration while evaluating the project. According to **Prof. Bruton**, *"project evah'ation should take into account the effects of a project on the rate of investment, on the growth rate of population on the acquisition of skills and managerial talents by the people"*.

III. **Tangible and Intangible Benefits**—(a) Benefits flowing from a project may be tangible or intangible. Tangible benefits are those which can be computed and measured in terms of money while intangible benefits cannot be measured in.

(b) Evaluation on the Basis of Costs—The calculation of cost of a project is very difficult because various types of costs are considered in its construction. Cost mean the value of resources used in the construction used in the construction of a project :

(1) Real and Nominal Costs—Costs may be real ornominal as they involve real sacrifice on the part of people or otherwise not. If money is borrowed from the people, it is a case of nominal cost. But if people are required to construct project themselves, they will be incurring real sacrifice and then it will be a case of real cost.

(2) Primary and Secondary Costs—Primary or direct costs are those which are directly incurred on the construction of a project but the secondary costs include the cost providing benefits to the people working on project such as cost of constructing houses, schools, hospitals etc. at the sight of project.

(3) Associated Costs—They are the value of goods and services needed beyond these included in the cost of a project to make immediate products or services of the project available for use of sale. For example, the farmer's cost of producing irrigated crops other than any charge for water would be his associated costs of producing crops.

(4) Project Costs—These are the value of resources used in constructing maintaining and operating the project. This includes cost of labour, capital, equipment, intermediate goods, natural resources and foreign exchange etc.

Thus, in evaluating a project, we are to compute and compare Its total benefits and total direct costs. If the benefits are expected to more than cost, then only the project is profitable otherwise not. The various steps of a project evaluation are as under :

1. Data is collected and calculated on physical quantities of goods and services produced.
2. On physical quantities of goods and services consumed.
3. The money value of these goods and services is computed on the basis of price index in different markets giving weight to inflationary and deflationary situation.

4. Annual costs are calculated by dividing the total costs by expected life of capital assets. Similarly annual benefits are computed by the money value of direct benefits flowing from the project and deducting from it associated costs of the project.

LIMITATIONS OF BENEFIT-COST ANALYSIS

Benefit-Cost analysis is a powerful technique regarding the selection and rejection of project even then it is not free from drawbacks. Some of its limitations are as under :

(1) Difficulties in Benefit Assessment—The correct estimation of benefits from a project also becomes difficult due to uncertainty regarding the future demand and supply of the products from a new project and their prices. Another difficulty arises from the existence of external economies. The presence of external economies may lead to selling of product of project at price equal to marginal cost and not equal to average cost which will create a deficit and efforts are made by a special levy on consumers or through budgetary resources.

According to Prof. Lewis, "to calculate the true net social benefit of an investment calls for skepticism as well as skill. The figures submitted to government almost always involve exaggerated optimism and double counting. If one uses low shadow wage in valuing labour, when calculating costs, one must not also, when calculating benefits give extra credit to the project because it will relieve unemployment. Shadow prices may be applied to costs or to benefits, the same item should not appear in both. Again annual values and capital value should not be added together."

(2) Arbitrary Discount Rate—The social rate of discount assumed for any project is arbitrary. There is no perfect method to find social discount rate. It remains a subjective phenomenon. But if there is a small change in social discount rate it may change the full results of project evaluation. The arbitrarily large discount rate does not help in calculating the net present value of benefits of long term projects.

(3) Ignores Opportunity Cost—It also ignores the problem of opportunity cost. **Griffin and Enos** state that if all prices reflect opportunity costs, all projects for which B/Cl would be chosen.

(4) Problem of Externalities—The side effects of a project are difficult to calculate in this analysis. There my be technological and pecuniary externalities of a river valley project, such as the effects of flood control measures or a storage dam on the productivity of land at other place In the vicinity.

(5) Difficulties in Selecting Appropriate Decision Rules—There are three decision rules for the evaluation of project. These are NPV criterion, IRR criterion and SRD criterion criterion. All these criterion have their own advantages and disadvantages. Therefore, it becomes difficult to decide as to which criteria should be used for the evaluation of the project because the wrong selection will lead to false conclusions.

(6) Difficulties in the Cost Assessment—Cost estimates are made on the basis of the choice of techniques, locations and prices of factor services used. Market prices of factors of production are used for this purpose provided they reflect opportunity cost. But in underdeveloped countries, market prices usually do not reflect the opportunity costs, because there is fundamental disequilibrium which is reflected in the existence of massive under-employment at the prevailing level of wages, the deficiency of funds at prevailing interest rates and the shortage of exchange at current rates of exchange. The equilibrium level of wage rates will be considerably lower than market wages while equilibrium interest rates will probably be much higher than market rates. To remove this difficulty, the use of 'shadow prices' or 'accounting' prices have been suggested by **J.Tinbergen** and **H.B. Chenery** and **K.S.**